WHAT IS CLAIMED

1. A system comprising:

a pulse-shaping filter that filters an input signal corresponding to a received plurality of training symbols and outputs the filtered signal;

a sampler coupled to receive the filtered signal, sample the received signal, and output a sampled version of the received signal; and

a pulse-shape estimator coupled to the sampler, the pulse-shape estimator calculating an estimated impulse response of the pulse-shaping filter based on the sampled version of the received signal and on an expected plurality of training symbols.

2. The system of claim 1, wherein the pulse-shaping filter is a transmit pulse-shaping filter, a receive pulse-shaping filter, or a cascade of the transmit and receive pulse-shaping filter.

3. The system of claim 1, wherein the expected plurality of training symbols are pre-stored in the pulse-shape estimator.

4. The system of claim 1, wherein the pulse-shape estimator calculates the estimated impulse response as:

$$\sum_m \underline{\hat{p}}_m \hat{p}_m(0)^*,$$

where $\underline{\hat{p}}_m$ represents the pulse-shape estimate for slot m of a time-division multiple-access signal and is given by

$$\left(A^H A\right)^{-1} A^H \underline{y}_m,$$

where A is a matrix representing the expected plurality of training symbols, the superscript H represents a Hermitian transpose, and $\underline{y}_m$ represents the sampled version of the received signal.

5. The system of claim 4, further comprising:

a synchronizer coupled between the pulse-shaping filter and the sampler, the synchronizer determining a sampling period for the sampler to sample the filtered signal.

6. The system of claim 5, further comprising:

an interpolator connected to the output of the pulse-shape estimator, the interpolator interpolating the estimated impulse response of the pulse-shaping filter to give the estimated impulse response of the pulse-shaping filter a higher effective sampling rate.

7. The system of claim 6, further comprising:

an antenna for receiving the input signal; and

a downconverter coupled to the antenna, the downconverter converting the received signal to a baseband signal and supplying the baseband signal to the receive filter.

8. The system of claim 1, wherein the system comprises a circuit in a mobile terminal.

9. The system of claim 1, further comprising:

a find compensation filter estimator coupled to the output of the pulse-shape estimator, the find compensation filter calculating coefficients for a digital compensation filter that minimizes the squared error between the estimated impulse response and a desired impulse response; and

a digital filter coupled to the sampler and the find compensation filter, the digital filter filtering the sampled version of the received signal using the calculated filter coefficients.

10. The system of claim 9, further comprising:

a demodulator connected to the output of the digital filter and recovers the symbols in the received signal.

11. A method for calculating an impulse response of a circuit in a mobile terminal comprising:

receiving an input signal;

converting the input signal to a baseband signal;

filtering the baseband signal with a pulse-shaping filter; and

estimating an impulse response of the pulse-shaping filter based on the filtered signal and on an expected signal.

12. The method of claim 11, wherein the input signal is transmitted according to the time division multiple access (TDMA) protocol.

13. The method of claim 11, wherein the expected signal comprises training symbols that are pre-stored on the mobile terminal.

14. The method of claim 11, further comprising:

demodulating the filtered signal to recover symbols transmitted with the input signal.

15. The method of claim 14, wherein the expected signal is derived from the demodulated filtered signal.

16. The method of claim 11, wherein the pulse-shaping filter is adjusted during the manufacturing process based on the estimated impulse response.

17. The method of claim 14, wherein demodulating the filtered signal to recover symbols transmitted with the input signal comprises:

using the estimated impulse response to refine the demodulating.

18. The method of claim 11, further comprising interpolating the estimated impulse response of the pulse-shaping filter to give the estimated impulse response of the receive filter a higher effective sampling rate.

19. The method of claim 11, wherein estimating an impulse response of the receive filter based on the filtered signal and on the expected signal comprises:

calculating $\sum_m \hat{\underline{p}}_m \hat{p}_m(0)^*$, where $\hat{\underline{p}}_m$ represents the pulse-shape estimate for slot m of a time-division multiple access signal and is given by

$$\left(A^H A\right)^{-1} A^H \underline{y}_m,$$

where A is a matrix representing the expected the signal, the superscript H represents a Hermitian transpose, and $\underline{y}_m$ represents the filtered baseband signal.

20. A system for calculating the overall channel response experienced by a mobile terminal comprising:

a pulse-shaping filter that filters an input signal corresponding to a received version of a plurality of training symbols and outputs the filtered signal;

a sampler coupled to receive the filtered signal, sample the received signal, and output a sampled version of the received signal;

a pulse-shape estimator coupled to the sampler, the pulse-shape estimator calculating an estimated impulse response of the pulse-shaping filter based on the sampled version of the received signal, an expected version of the plurality of training symbols, and on medium response coefficients that define characteristics of the medium between the mobile terminal and a transmitting station;

a channel estimator coupled to receive the output of the pulse-shape estimator, the channel estimator calculating the medium response coefficients and calculating an overall channel input response based on the estimated impulse response, the channel estimator transmitting the medium response coefficients to the pulse-shape estimator; and

a demodulator that receives the overall channel input response from the channel estimator and the sampled version of the received signal, the demodulator using the overall channel input response to recover the received signal from the sampled signal.

21. The system of claim 20, wherein the pulse-shaping filter is a transmit pulse-shaping filter, a receive pulse-shaping filter, or a cascade of the transmit and receive pulse-shaping filter.

22. The system of claim 20, wherein the expected version of the plurality of training symbols are pre-stored in the pulse-shape estimator.

23. The system of claim 20, wherein the input signal is transmitted using the time division multiple access (TDMA) protocol.

24. The system of claim 23, wherein the pulse-shape estimator calculates the estimated impulse response for slot $m+1$ in the TDMA protocol using a least mean squares (LMS) algorithm, the algorithm comprising:

calculating

$$\underline{\hat{p}}_m + \beta \hat{G}_m^H A^H \underline{\varepsilon}_m ,$$

where $\underline{\hat{p}}_m$ represents the pulse-shape estimate for slot m of a TDMA signal, β represents a step size in the LMS algorithm, $\hat{G}_m$ represents a matrix of estimated medium response coefficients for slot m, and $\underline{\varepsilon}_m$ represents an error signal for slot m.

25. The system of claim 22, further comprising:

a synchronizer coupled between the pulse-shaping filter and the sampler, the synchronizer determining a sampling period for the sampler to sample the filtered signal.

26. The system of claim 25, further comprising:

an antenna for receiving the input signal; and

a downconverter connected to the antenna, the downconverter converting the received signal to a baseband signal and supplying the baseband signal to the pulse-shaping filter.

27. The system of claim 20, wherein the system is a circuit in the mobile terminal.

28. A mobile terminal comprising:

a pulse-shaping filter that filters a signal received by the mobile terminal and outputs a filtered signal;

a sampler coupled to receive the filtered signal, sample the received signal, and output a sampled version of the received signal;

a pulse-shape estimator coupled to the sampler, the pulse-shape estimator calculating an estimated impulse response of the receive filter based on the sampled version of the received signal and on an expected version of the received signal; and

a component coupled to the output of the pulse-shape estimator, the component receiving the estimated impulse response of the pulse-shaping filter from the pulse-shape estimator and using the estimated impulse response to improve the reception of the received signal.

29. The mobile terminal of claim 28, wherein the pulse-shaping filter is a transmit pulse-shaping filter, a receive pulse-shaping filter, or a cascade of the transmit and receive pulse-shaping filter.

30. The mobile terminal of claim 28, wherein the component coupled to the output of the pulse-shape estimator is a channel estimator that calculates an overall channel impulse response based on the impulse response from the pulse-shape estimator.

31. The mobile terminal of claim 30, further comprising:

a demodulator that receives the overall channel input response from the channel estimator and the sampled version of the received signal, the demodulator using the overall channel input response to recover the received signal from the sampled signal.

32. The mobile terminal of claim 28, wherein the component coupled to the output of the pulse-shape estimator comprises:

a compensation filter estimator coupled to the output of the pulse-shape estimator, the find compensation filter calculating coefficients for a digital compensation filter that minimizes the squared error between the estimated impulse response and a desired impulse response; and

a digital filter coupled to the sampler and the compensation filter estimator, the digital filter filtering the sampled version of the received signal using the calculated filter coefficients.